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ABRAHAM, SALIEU M	

ART UNIT	PAPER NUMBER
3768	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/750,096	CAFARELLA, JOHN H.	
	Examiner	Art Unit	
	SALIEU M. ABRAHAM	3768	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21,80-96 and 98-101* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21,80-96 and 98-101* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments/Remarks

1. Examiner acknowledges the following corrections and amendments to objectionable subject matter cited in the first action on the merits filed November 23, 2007 :

- the objection to the word "doubting" was in reference to a misspelling in the specified section (0034) of applicant's pregrant publication (**applicant PgPub**) for the proposed invention, US 2004/0220465 A1. Please disregard as this is a typographical error and was not found in the original specification,
- cancellation of duplicate claim 97,
- amended claims 100 and 101 to recite system and not method limitations for proper claim antecedent basis.

2. In light of item 1), all objections are hereby withdrawn.

3. Applicant's arguments with regard to claims 1-21, 80-96, and 98-101 filed May 23, 2008 have been fully considered, but they are not persuasive.

4. The crux of applicant's arguments is centered on independent claims 1, and 80 and the addition of the requirement for the diagnostic techniques employed to be of "commensurate resolution". Specifically, the applicant states:

a) The two modalities offered by the Zhu primary reference are not equivalent **to any two recited, in claims 1 and 80** and particularly, the Zhu NIR modality is incapable of the "resolution offered by photo-acoustic imaging". Applicant further asserts that "the two techniques suggested by Zhu do not offer commensurate resolution".

b) Also regarding claims 1 and 80, applicant asserts that the resolution of each of the probing methods must be commensurate with each other, such that confirming information regarding malignancy can be made locally in the tissue" and Zhu's wording of "within a region" is not equivalent to applicant's "voxel-by-voxel".

c) The lack of a "commensurate resolution" and three separate probing methods in the Whiting and Kruger secondary references fail to overcome the shortcomings of Zhu.

5. **Regarding item a):** applicant admits that their proposed invention is intended to use multimodal screening techniques (**e.g. single modalities in combination**) to improve cancer (tumor) detection and these techniques include the NIR optical and ultrasonic modalities of Zhu (**see applicant PgPub abstract, figure 12a and sections [0114 – 0118]**). Additionally, the prior FAOM filed November 23, 2007, argued that while the Zhu reference did not disclose three or more multimodal techniques, it substantially disclosed applicant's invention of combining individual modalities together to derive an improved diagnostic benefit (**see item 6/claims 1 and 80 rejections on pp. 3 and 4**). Further, adding more modalities based on their usefulness to provide additional screening details when used in combination with other modalities is well within the level

of ordinary skill as suggested by Zhu (**see abstract and columns 6, lines 66-67 and 7,lines 1-25**) and applicant (**see applicant PgPub sections [0051-0052 and 0055]**). Lastly, applicant would appear to have indicated contradictory arguments with regard to his proposed invention in light of having to use NIR (diffusive IR) and ultrasonic modalities as two of the possible three final modalities for tumor screening. As such, the differences in their resolution detection capability (i.e. when a NIR, ultrasound and electromagnetic screening regimen is used) would still exist. However, as applicant discloses this (NIR – ultrasound) combination is used to take advantage of the "high contrast benefit" of NIR and "high spatial resolution" benefit of ultrasound in order to yield a combined result with both benefits displayed in the resulting data (i.e. a composite image with diagnostically resolvable spatial and contrast information). This is the basis/rationale for combinations of all ***singular modalities into a multimodal technique for improved screening*** (**see applicant PgPub sections [0110 – 0118]**).

In comparing the NIR and ultrasound modalities of Zhu with the photo-acoustic modality of applicant, applicant has selected modalities which are designed to highlight different types of resolution and, correspondingly, for producing and highlighting different results. Examiner respectfully submits that Zhu's NIR and ultrasound modalities are equivalent to those of applicant and distinct from applicant's photo-acoustic technique. (**See applicant PgPub sections [0110 – 0118]**).

6. **Regarding items b) and c):** in light of the arguments supra, applicant's arguments

are moot as a basis has been established for using a multimodal screening approach for tumor detection and this would include modality combinations with both spatial and/or contrast or other resolution benefits as dictated by the study under investigation or as a matter of design choice.

7. In light of the amended subject matter and the remarks in items 3-5, the instant action is changed only to further clarify why the prior art still renders the proposed invention obvious and this action is hereby made **final**.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1 – 2, 9-20, 80 - 81 and 88-100 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 6,264,610 to Zhu (Zhu) in view of Examiner's Official Notice (EON).

In Reference to Claims 1 and 80

Zhu discloses all limitations for method claim1 and corresponding system claim 80 with the exception of "acquiring spatial data with respect to the region of interest **using at least three separate probing methods**" and the requirement for "commensurate resolution" of photo-acoustic technique; technically, Zhu uses two probing methods, although according to applicant's definition of probing method he could potentially use up to four (one optical and three ultrasound).

However, in view of the Zhu disclosure (see column 7, lines 12-24) it would be obvious to one of ordinary skill that his multimodal system could be modified or adapted to incorporating more probing methods without deviating from the scope of the invention: using multimodal imaging to provide both physiological and diagnostic data for enhancing "the ability to distinguish a tumor from normal tissue" (see column 7, lines 9-12). Further, once this basis is established, then inclusion of the other (i.e. photo-acoustic) modalities would allow for "commensurate resolution" combinations of screening techniques. Also, as discussed in the arguments supra, Zhu's NIR optical and ultrasound techniques are equivalent to those of applicant and distinct from applicant's photo-acoustic technique. In light of these rationales one of ordinary skill would find that Zhu meets all limitations for claims 1 and 80.

Specifically Zhu discloses:

(**Re claim 1**): A method of detecting the presence of malignant tissue within a region of interest within a living body, wherein the malignant tissue is characterized by one or more physical manifestations differentiating it from normal tissue, comprising: (see column 7, lines 9-12)

a) acquiring spatial data with respect to the region of interest using at least three separate probing methods, each probing method being of the type that senses the presence of malignant tissue within the region of interest by sensing at the presence of a physical manifestation associated with the malignant tissue; (see abstract and claims

1,2 and 6)

and

b) co-registering the acquired spatial data from all of the probing methods so as to improve the receiver operating characteristics of detection performance (see abstract and columns 6, lines 66-67 and 7, lines 1-12)

(**Re claim 80**): A system for detecting the presence of malignant tissue within a region of interest within a living body, wherein the malignant tissue is characterized by one or more physical manifestations differentiating it from normal tissue, comprising: (see column 7, lines 9-12)

a) a data acquisition subsystem constructed and arranged so as to acquire spatial data with respect to the region of interest using at least three separate probing methods, each sensing modality being of the type that senses the presence of malignant tissue within the region of interest by sensing at the presence of a physical manifestation associated with the malignant tissue; (see claim 6 and column 7, lines 9-12)

and

b) a data registration subsystem constructed and arranged so as to co-register the acquired spatial data from all of the probing methods so as to improve the receiver operating characteristics of detection performance. (see claims 7 and 11 columns 6, lines 66-67 and 7, lines 1 - 12)

In Reference to Claims 2 (Method) and 81 (System)

Zhu further discloses:

(**Re claim 2**): A method of claim 1, wherein at least one of the probing methods is ultrasonic, and acquiring spatial data includes receiving backscattered signals from the tissue. (see abstract and claim 6)

(**Re claim 81**): A system of claim. 80, wherein at least one of the probing methods is ultrasonic, and the data acquisition subsystem includes a receiver constructed and arranged so as to receive backscattered signals from the tissue. (see abstract and claim 6)

Therefore, Zhu in view of EON meets all claim 2 and 81 limitations.

In Reference to Claims 9 (Method) and 88 (System)

Zhu in view of EON has been shown to teach all claim1 and 80 limitations. Zhu further discloses:

(**Re claim 9**): A method of claim 1, further including interpreting the co-registered data. (see column 1, lines 57-67)

(**Re claim 88**): A system of claim 80, further including a data interpreter constructed and arranged so as to interpret the co-registered data. (see figure 4 and column 5, lines 1-9).

Therefore, Zhu in view of EON meets all claim 9 and 88 limitations.

In Reference to Claims 10-11 (Method) and 89-90 (System)

Zhu in view of EON has been shown to teach all claim 8 and 88 limitations. Zhu further discloses:

(**Re claim 10**): A method of claim 9, wherein interpreting the co-registered data includes automatically detecting data indicating the presence of malignant tissue within the region of interest. (see figure 4, column 6, lines 12-36 and column 7, lines 2-12)

(**Re claim 89**): A system of claim 80, further including a data interpreter constructed and arranged so as to interpret the co-registered data. (see figure 4, reference marks 106

and 108)

Therefore, Zhu in view of EON meets all claim 10 and 89 limitations.

(**Re claim 11**): A method of claim 9, wherein interpreting the co-registered data includes generating the co-registered data as image data. (see column 7, lines 1-12)

(**Re claim 90**): A system of claim 89, wherein the data interpreter is constructed and arranged so as to generate the co-registered data as image data. (see claims 15-18 and column 5, lines 4-9)

Therefore, Zhu in view of EON meets all claim 11 and 90 limitations.

In Reference to Claims 12 (Method) and 91 (System)

Zhu in view of EON has been shown to teach all claim 11 and 90 limitations. Zhu further discloses:

(**Re claim 12**): A method of claim 11, wherein the data acquired by each modality is represented by a different color so that tissue within the region of interest is represented by a pseudo color representation. (see column 6, lines 47-49 and claim 17)

(**Re claim 91**): A system of claim 90, wherein the data acquired by each modality is represented by different color so that image data of tissue within the region of interest is represented by a pseudo color representation. (see claims 17 and 18)

Therefore, Zhu in view of EON meets all claim 12 and 91 limitations.

In Reference to Claims 13 (Method) and 92 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Zhu further discloses:

(**Re claim 13**): A method of claim 1, wherein acquiring spatial data includes using a hand-held instrument positioned so as to be stationary relative to the region of interest during the acquisition of such spatial data. (see figure 3, reference mark 10 and column 2, lines 49-64)

(**Re claim 92**): A system of claim 80, wherein the data acquisition subsystem includes a hand-held instrument positioned so as to be stationary relative to the region of interest during the acquisition of such spatial data. (see figure 3, reference mark 10 and column 2, lines 49-64)

Therefore, Zhu in view of EON meets all claim 13 and 92 limitations.

In Reference to Claims 15-16 (Method) and 94-95 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Zhu further discloses that the transceiver array may be of different (multi-) dimensions. (see claims 2 and 3).

Therefore, Zhu in view of EON meets all claims 15-16 and 94-95 limitations.

In Reference to Claim 17 (Method) and 96 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Zhu further discloses the well known dual benefits of contrast afforded by optical methods such as NIR and resolution afforded by ultrasound for detecting with high specificity cancerous

tissue. M-of-N detection is a routine and well known protocol employed in the pattern recognition or sample screening/detection arenas for providing a reasonable level of confidence regarding accuracy of screening results such as applicant refers to regarding his proposed invention. It would be obvious to one of ordinary skill that a likelihood of M-of-N detection would be included for the tumor detection scheme of applicant.

Therefore, Zhu in view of EON meets all claim 17 and 96 limitations.
Note: Claim 97 is a duplicate of claim 96 (see claim objections).

In Reference to Claim 18 (Method) and 98 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Zhu further discloses a system and method encompassing an exemplary B-mode ultrasound probing method. However, Zhu, unlike applicant, is not detecting blood flow. Doppler ultrasound is a well known blood flow detection ultrasound modality. Therefore, one of ordinary skill would expect that it would be the ultrasound mode of choice for any application involving the detection of blood flow.

Therefore, Zhu in view of EON meets all claim 18 and 98 limitations.

In Reference to Claims 19 (Method) and 99 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Zhu further discloses a system and method "wherein at least one of the probing methods is electromagnetic probing of dielectric permittivity. (see abstract and column 6, lines 20-30 and lines 36-40).

Therefore, Zhu in view of EON meets all claim 19 and 99 limitations.

In Reference to Claim 20 (Method) and 100 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Zhu further discloses a system and method encompassing at least one probing method of diffusive IP probing of tissue (see abstract and claims 1 and 15).

Note: Claim 100 was interpreted as "A system of claim 80" and not "A method of claim 80" as stated (see claim objections).

10. Claims 3 - 4, 82 and 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 6,264,610 to Zhu (Zhu) in view of Examiner's Official Notice (EON) further in view of US Pat. No. 4,509,368 to Whiting (Whiting).

In Reference to Claims 3-4 (Method) and 82-83 (System)

Zhu in view of EON has been shown to teach all claim1 and 80 limitations. However, Zhu in view of EON fails to teach:

(**Re claim 3**): "A method of claim 1, wherein at least one of the probing methods is ultrasonic, and acquiring spatial data includes receiving transmitted signals through the tissue in the region of interest", and

(**Re claim 82**): "A system of claim 80, wherein at least one of the probing methods is ultrasonic, and the data acquisition subsystem includes a receiver constructed and arranged so as to receive transmitted signals through the tissue in the region of

interest."

Whiting, in the same field of endeavor, discloses a system and method for ultrasound tomography for use in clinical diagnostics comprising paired couples of transmission and reflection transducers (see abstract). He cites that this approach allows for significant improvements in speed and accuracy of data acquisition (see abstract and column 3, lines 16-24).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have incorporated the transmission signal reception capability (apparatus and method) of Whiting in the system and method of Zhu in view of EON in order to "provide a rapid, more reliable technique for non-invasive" diagnostics that make use of ultrasound as explicitly taught by Whiting.

(**Re claims 4 and 83**): **Zhu** in view of EON has been shown to teach all claim1 limitations. Furthermore, Whiting has been shown to teach a system and method that is capable of receiving both " backscattered and transmitted signals through the tissue in the region of interest". (see abstract and column 4, lines 1-46).

Therefore, Zhu in view of EON further in view of Whiting meets all claim 4 and 83 limitations.

11. Claims 5-8, 21, 84-87 and 101 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 6,264,610 to Zhu (Zhu) in view of Examiner's Official Notice (EON) further in view of US Pat. No. 5,713,356 to Kruger (Kruger).

In Reference to Claims 5 (Method) and 84 (System)

Zhu in view of EON has been shown to teach all claim1 and 80 limitations. However, Zhu in view of EON fails to disclose:

(**Re claim 5**): "A method of claim 1, wherein acquiring spatial data with respect to the region of interest includes compounding so as to acquire independent samples of an image point so as to reduce speckle".

(**Re claim 84**): "A system of claim 80, wherein the data acquisition subsystem is further constructed and arranged so as to acquire independent samples of an image point so as to compound data and reduce speckle".

Kruger, in the same field of endeavor, discloses a system and method for using energy in the electromagnetic spectral domain for sampling and analysis of biologic tissues in vivo, particularly the breasts (see abstract). Kruger further discloses (compounding so as to reduce speckle) "obtaining independent samples of an image point" by respectively using different ultrasonic carrier frequencies or/and different angular aspects (see figures 1 <system>, 3, 4 and 15 <method>) in order to produce a medically useful diagnostic image from the tissue, which are the direct result of sonic waves (see abstract and claims 1 and 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have incorporated the system and method of compounding so as to reduce speckle of Kruger in the system and method of Zhu in view of EON in order to produce a medically useful diagnostic image from a region of interest as explicitly taught by Kruger.

In Reference to Claims 6-8 (Method) and 85-87 (System)

Zhu in view of EON further in view of Kruger has been shown to teach all claim 5 and 84 limitations. Additionally, it was also shown that Kruger teaches the claims 6-8 and 85-87 limitations of using ultrasound wave disparate frequencies and angulations to reduce speckle and compose/construct images of the target region in vivo (see abstract,

figure 1, column 3, lines 9-60 and column 14, lines 7-37).

Therefore, Zhu in view of EON further in view of Kruger meets all claims 6-8 and 85-87 limitations.

In Reference to Claims 21 (Method) and 101 (System)

Zhu in view of EON has been shown to teach all claim 1 and 80 limitations. Kruger further discloses a system and method "wherein at least one of the probing methods is photo-acoustic probing of tissue properties. (see abstract and figure 15).
Therefore, Zhu in view of EON further in view of Kruger meets all claim 21 and 101 limitations.

Conclusion

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Salieu M. Abraham whose telephone number is (571) 270-1990. The examiner can normally be reached on Monday through Thursday 9:30 am - 7:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Casler can be reached on (571) 272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

8/30/08 SA

/Brian L Casler/
Supervisory Patent Examiner, Art Unit 3737